Students' Attitudes on Cancer: The Development, Implementation and Evaluation of a Small Group Discussion Unit

An Honors Thesis (Honors 499)

by

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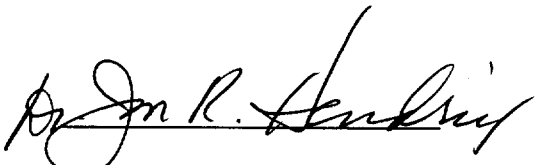

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I. Abstract

The focus of this project was the development, implementation and evaluation of a small group discussion for the Honors 299 Class.

Honors 299, or "Human Genetics and Bioethical Decision-Making" is a class covering genetic material and bioethical decision models. One portion of the course involves discussions involving between ten and twelve students about ethical issues in genetics.

For this project, a discussion unit over the topic of cancer was developed. The unit consisted of two parts: a hypothetical case study and a section of background information. The case study was designed to stimulate thought and discussion about cancer. The background information was intended to supply the students with the information they would need to discuss the topic in depth.

The students were given the packet before their discussion groups met. Each group included ten to twelve students and a discussion leader. The groups met for one hour discussions.

The effectiveness of the discussion materials was evaluated by comparing the results of a pretest and a post-test. This test included multiple-choice, short-answer and opinion questions. A t-test analysis of the test scores indicated that students had significantly increased in their knowledge about cancer.

II. Acknowledgements

I would like to express my deep appreciation for all of the people who assisted me in the course of putting together this unit. First of all, my thanks go out to Dr. Jon Hendrix, my advisor, who guided me through this entire process. Also, thanks to the staff of the St. John's Medical Center Library who helped me with my research and to the staff of the University Computer Labs for helping me with my online research. This project could not have taken place without the participation of the Fall 1998 sections of Honors 299 and Bio 390 class. Their participation, comments and suggestions have helped me refine the unit. To all of these people, and to the many others who have also helped me in so many ways I give you my heartfelt thanks.

III. Introduction

There are few diseases as feared in our society as cancer, and for good reason. Cancer is the second leading killer in the United States. Cancer causes the deaths of one out of every four people in the United States. Cancer kills more people each year than cerebrovascular disorders, accidents, HIV infections, suicides, and homicides combined(American Cancer Society, 1997g). It is little wonder why this disease is so frightening and difficult to talk about.

Cancer is a difficult subject for many people to discuss. It has touched the lives of nearly everyone in some way. Nearly everyone has either fought cancer, known someone who has fought cancer or known someone who has died from cancer. The word brings up frightening, painful emotions which many people have difficulty expressing. One of the purposes for this case study was to develop a packet which would help facilitate small group discussions about this emotional topic. The packet was meant to give students an opportunity to gain a level of comfort discussing cancer.

Open discussion about cancer is important because it fosters understanding and helps people learn about the disease. Today's media are continually providing us with information about cancer. Television, print and radio ads are continually presenting information about causes, treatments and discoveries about the disease. Much of this

information is accurate, much is not. Discussion helps people learn about the disease and dispel frequently held myths.

While cancer is not entirely preventable, there are many things that an individual can do to lower their chances of developing different types of cancer. In order for people to make informed lifestyle choices they need to have as much information as possible. Unfortunately, the incredible amount of information available to the average person makes it difficult to sift through and find the information they need. Too often people react in one of two ways; they are overwhelmed by the information and block it all out, or they find themselves living in fear and making unreasonable lifestyle decisions because they are afraid that everything will cause cancer.

The problem addressed in with this study is that college students are either not aware of, or do not care about the impact their lifestyle choices have on their chances of developing cancer. Both because they don't feel comfortable talking about the subject and because they feel overwhelmed by the amount of information available, students are too often ignoring the potential consequences of their lifestyles.

The purpose of the discussion packet in Appendix B is not to be a comprehensive source of information on the causes of cancer. Such a work is entirely beyond the scope

of any single paper. There are two goals for this packet. The first is to facilitate a small group discussion where students can talk about an emotional issue. The second is to provide general information about cancer and some of its risk factors so that students are stimulated to think about the potential effects of their lifestyle choices.

IV. Literature review

The majority of the research done for this project was done online. Using the Internet, I was quickly able to find much of the information I needed.

The majority of the statistics come from the World Wide Web pages of the American Cancer Society (American Cancer Society, 1995a-b, 1996a-c and 1997a-n). These pages provided easy access to the statistical information including the number of cancer cases in recent years, five year survival rates for different cancers, and much more. These pages also provided many of the recommendations for the prevention of cancer.

The University of Pennsylvania's "Oncolink" web page (University of Pennsylvania, 1998) provided valuable information on the genetic basis for cancer. It explained the multiple-hit hypothesis in which multiple exposures to mutagens cause changes in cells' DNA. These changes are cumulative. The changed cells pass on the damage when they replicate. Over time, these changes can cause a cell to lose

its ability to regulate cell replication, thus forming a cancerous cell. The article "Cancer Genetics Network Gets Under Way," (Nelson, 1997) and "Gene Therapy for Cancer: Where are we Going," (Roth and Christiano, 1997) also described the role genetics plays in the development of cancer. Cancer is a genetic disease, both in the fact that susceptability to certain types of cancer can be passed along from parent to child and in the fact that cancer is caused by changes in the DNA sequence.

The article "Early Detection of Cancer, Psychologic and Social Dimensions," (Bloom, 1994) explained some of the attitudes people have about early detection of cancer. According to Bloom, many are afraid that finding cancer early will not affect their survivability but will simply reduce the quality of their remaining life.

Psychology Applied to Teaching (Biehler, 1974) described what was necessary for an effective small group discussion. Groups need to have common ground in order to feel comfortable sharing their experiences. Groups should have enough diversity so that differing views will exist and be voiced. Biehler's information (1974) was used while designing the discussion unit.

Evaluation of new educational materials is discussed in depth in the book Educational and Psychological Measurement and Evaluation (Hopkins et. al., 1990). This book discussed both how to develop tests and how to interpret the results

of those tests. A multiple choice format was chosen for the majority of the test because it could eliminate subjectivity in scoring (Hopkins et. al., 1990).

The decision to use a two-tailed t- test was made after the recommendations of Dr. Jon Hendrix. Day and Underwood (1991) provided more details on how t-tests worked.

V. Method

Development of a Case Study

Honors 299, Human Genetics and Bioethical Decision Making, is a required course in the Honors College curriculum. The course consists of three parts; lecture, lab and small group discussion. One of the goals of the course is to help the students develop personal frameworks for making ethical decisions. This is the goal emphasized during the small group discussions. The course includes three small group discussions, each over a different topic. The discussions allow the students to analyze topics in depth and form their own opinions on the topics. One of the topics covered by the discussions is cancer.

In developing a discussion unit the first step was in determining my goals for the discussion. There were two goals I considered important for this discussion.

1. Students should recognize the enormous impact cancer has on society and individual lives.
2. Students should understand the impact their

individual choices have on their chances of developing cancer.

Robert Biehler describes how a group discussion should be formatted (Biehler, 1974). "The first requirement for group investigation is a teachable group: one which can develop a common cause, one whose members can stimulate each other.... The students are assigned to a consultant who confronts them with a stimulus situation to which they can react and discover basic conflicts among their attitudes, ideas and modes of perception." Beihler also describes certain conditions which need to be met for small group discussions to be effective. These include:

1. The groups need to be small enough so that each member can be heard. Each group should be no larger than fifteen members.
2. The groups need to be able to find some type of common ground.
3. Groups should have enough diversity so that there is the possibility for 'temperamental conflict.' The students should be able to '...react differently to the same reality stimulus; there should be the possibility of clashes.' (Beihler, 1974)

The discussion packet was designed to meet each of these conditions. Each group of ten to fifteen students was assigned to a facilitator. This facilitator was from the Biology 390 course. Biology 390 was a course available to

students who have completed Honors 299. Students in Biology 390 were trained to lead discussion groups. They learned about group dynamics, how to format discussions and how to involve other students in those discussions.

The case study was the reality stimulus for the students' reactions. All of the students had some common ground because all, or very nearly all, of the students have had some experience with cancer.

The discussion unit was designed to provide a framework to stimulate discussion along with a reference section to provide students with additional information to aid in their discussion.

The case study was designed to facilitate discussion. It presented a situation which is relevant to the students' lives. The case study presented a conversation between two students before class. Each has a family history of cancer and both students discuss how they and their family deal with cancer.

The idea for the case study came from personal experience. The characters in it are based on members of my own family. They run from totally unconcerned about the possibility of cancer to living in constant fear of the disease. The hope was that the students would recognize the traits in the case study characters as familiar to people in their own lives. The students in each group found themselves identifying more with one of the characters in the case

study, than the others. This provided the "temperamental conflict" needed for the discussion to advance.

The remainder of the packet is an informational section. This is meant to be used as a reference by the students during the discussion. It is not meant to be a self-contained lesson about cancer. At the time of the small group discussion the students will have had a lesson on cancer during the lecture portion of the class. The students will already have prior knowledge about cancer. The reference portion of the packet was provided to the students to help provide background information about cancer. It provided general information on cancer, its causes and its effect on society.

Before the students were given the discussion packet, they were given a pre-test covering the material in the packet. The final question on this test asked the students what they hoped to get from the discussion. From the sixty-seven students who took the test there were sixty responses to this question. The answers to this question varied but typically fell into one of the categories shown on the following table.

Category	Number of Responses
Cancer risks and prevention	30
General cancer information	9
Treatment of cancer	5
How to cope with having cancer	5
Relationship between genes and the environment	4
Share personal experiences and talk about fears	3
Common misconceptions about cancer	4

Refinements were then made to the discussion packet based on the students' expectations of the discussion.

Implementation of the Discussion Packet

After the packet was written it was tested with the fall 1997 section of the honors 299 class. The class was divided into groups of ten to twelve students, each led by one student from the biology 390 class. The biology 390 class is a class made up of students who have been studying how to facilitate discussions. Their responsibilities include leading each of the small group discussions.

The groups met for one hour over each topic, in place of that week's laboratory period. The format for each discussion varied. Each discussion group leader ran his or her group differently, based on what they believed would be effective with their group of students

Development of the Evaluation Instrument:

In order to compare the students' knowledge and attitudes before they participated in the small group discussion and their knowledge and attitudes after the small group discussion, a test was given to the students before they received their packet and at the conclusion of the small discussion. The students' raw pretest and post-test scores can be found in Appendix D.

Students received a score based on how many of the answers they completed correctly. This allowed a quantitative assessment of their knowledge and attitudes before and after they participated in the discussion unit. Quantification is important because it allows "...information to be communicated and interpreted with less ambiguity and less subjectivity than would otherwise be the case" (Hopkins et. al. 1990).

The first step in constructing any test is two consider the goals and objectives for the packet. Goals are broad, general desired outcomes, while objectives are specific and measurable. Care must be taken so that the evaluation instrument measures the desired objectives. As stated earlier, the goals for this unit were:

1. Students should recognize the enormous impact cancer has on society and individual lives.
2. Students should understand the impact their individual choices have on their chances of

developing cancer.

I then broke the goals down into smaller objectives in order to facilitate writing relevant questions.

1a. Students will recognize the societal impact of cancer.

1b. Students will identify ways to minimize the impact of cancer on individuals.

and

2a. Students will describe the process by which normal cells become cancerous.

2b. Students will list lifestyle choices which can affect the process of carcinogenesis.

Questions were then written to evaluate students progress for these objectives. A multiple choice format was chosen for the majority of the test because multiple choice tests "1)...require the examinee to discriminate among alternatives that can require a level of mastery that a free-response item may not be able to detect, and 2) remove ambiguity and subjectivity in scoring." (Hopkins et. al. 1990.)

In addition to the ten multiple choice questions, there were three short answer questions. These questions allowed students to explain how well they understood the material.

After the test was written it was shown to Dr. Jon Hendrix, the professor of both the biology 390 and the honors 299 courses. Dr. Hendrix, an expert in genetics and

the bioethical decision making process, confirmed that the test instrument measured the stated objectives.

The test instrument can be found in Appendix D. Also included in the appendix is a table describing which questions test each objective.

In addition to the thirteen questions dealing with the students' understanding of the material in the packet, there were three questions designed to measure changes in the students' attitudes towards cancer.

Evaluation of the Discussion Unit:

In evaluating this discussion unit, two factors were considered. The first was the change in the students' knowledge of cancer. The second was their changes in attitudes about cancer. The pretest and post-test were designed to measure both of these.

The case study was evaluated through a pretest, taken during a honors 299 class meeting and a post-test, taken immediately following the small group discussion. There were approximately three weeks between the pretest and the post-test. The test covered both the students' knowledge of cancer and their opinions about the subject. Students were asked to write an identification number on their test form so that it would be possible to see how individuals improved. There were sixty-seven students who took the pretest and sixty-eight who took the post-test. The raw

scores for the students can be found in Appendix D. The average score for all 67 scores on the pretest was 8.36 out of a possible 13 points. The average score for the sixty-eight students taking the post-test was 10.11. There was a 1.76 point improvement in the average scores between the pretest and post-test scores for all students.

Out of the total sixty-seven students who took the test, fifty-seven were identified as taking both the pretest and the post-test. The following table shows the results from the students who took both the pretest and the post-test.

Test Results and t-Test

	Pretest	Post-test	Difference
Mean	8.37	10.11	1.74
N = 57	Df = 56	t = 6.03*	

*P<.05

Of the fifty-seven students who took both the pretest and post-test, forty-two improved their scores, five showed no change and ten showed a lower score during the post test. This means that seventy-three percent of the students taking both the pretest and the post-test showed an improvement, presumably due to the discussion material and the small group discussion.

To determine if the test scores were significantly higher after the discussion unit, a two-tailed student t-test was performed on the data. This test determines if the

probability that the differences in the pretest scores and the post-test scores were due to random chance. The t-test was run on the Minitab statistical program on the Ball State University mainframe. The t-value obtained from the program was 6.03. With fifty-six degrees of freedom, the minimum t-value for a .05 level of significance is 2.064. Since the t-value calculated is greater than 2.064 it can be said with 95% assurity that the differences between the pretest and the post-test are due to a factor other than chance.

The test also consisted of three questions measuring the student's opinions on cancer. These were statements to which the student chose strongly agree, agree, not sure, disagree or strongly disagree to describe their feelings. The statements were:

1. I feel comfortable talking about cancer.
2. I am concerned about developing cancer.
3. I try to avoid choices that put me at risk for developing cancer.

The results to these questions are shown on the tables below.

Table 1. Students responses to opinion questions on both pretest and post-test.*

#	Pre SA	Post SA	Pre A	Post A	Pre NS	Post NS	Pre D	Post D	Pre SD	Post SD
1	51%	50%	43%	44%	5%	4%	1%	1%	0%	0%
2	13%	9%	40%	41%	30%	35%	13%	15%	2%	0%
3	14%	18%	48%	56%	19%	14%	13%	12%	4%	0%

*percentages may not total 100 due to rounding

The table shows that the students attitudes about cancer did not change as much as their knowledge did. Before the discussion 94% of the students felt comfortable talking about cancer. That number remained unchanged after the discussion. The students' concern about developing cancer also did not change much. Before the discussion 53% of the students either strongly agreed or agreed with the statement "I am concerned about developing cancer." After the discussion 50% strongly agreed or disagreed with the statement.

The one area where students attitudes did change was in avoiding lifestyle choices that would put them at risk for cancer. Before the discussion 62% of the students believed that they tried to avoid choices that put them at risk for cancer. After the discussion 74% of the students reported they would try to avoid choices that would put them at risk of developing cancer. This is significant because this demonstrates that students are planning to make changes in their lifestyles based on what they have learned during the unit.

The final portion of the test allowed students to express any comments they had concerning what they perceived as the strengths and weaknesses of the discussion packet. The majority of the responses were positive, although there were many suggestions for improvements.

Students major concern was about preventable causes of

cancer. Of the thirty students who made comments, nineteen concerned cancer risks and prevention. Twelve of those comments said that the information in the packet was adequate. Seven said that there was not enough information about the different causes of cancer. One student said, "You wasted too much time talking about cigarettes. We know that stuff. What else causes cancer?"

Several students said that the discussions were good times to express their feelings and learn what others felt about this issue. Two mentioned that the packet started their discussion but that the discussion quickly went to a variety of topics not covered in the packet. This is part of the purpose of the packet. I wanted the packet to allow the participants to start off with some common ground, but I certainly did not want the discussions confined to the material in the packet.

One common criticism was the lack of a clear cut ethical question in the case study. Four students complained that the case study did not have an ethical situation that needed to be addressed. In the words of one student, "I got a lot of information, but it really wasn't an ethical issue at all, nothing to discuss."

While there were several different criticisms, overall the response was positive. The general feeling seemed to be that while the discussion was not perfect; however it was effective.

VI. Conclusions

This discussion unit was assessed as a beneficial addition to the honors 299 course. The packet assisted the students in understanding cancer and how it is relevant to their lives. The test scores demonstrate that the students knowledge and understanding of cancer did increase. The data for the fifty-seven students who took the both the pretest and the post-test showed a significant increase in scores. The average pretest score for those fifty-seven students was 8.37, while the average post-test score was 10.11, an increase of 1.74. Student t-test analysis of this data determined that this was a significant difference between the scores. This difference could not be attributed to chances. Presumably the difference was the result of the students' participation in the discussion unit.

The results also showed that there were changes in the students attitudes concerning their on behaviors and their relationship to developing cancer. Before the discussion unit sixty-two percent of the students involved in the study reported that they tried to avoid lifestyle choices that increased their risk for developing cancer. After the study seventy-four percent reported that they avoided risky behaviors. While it is impossible to determine how many students actually made changes in their lifestyles to avoid cancer, the results of the attitude questions do indicate that there was a significant increase in students intending

to make lifestyle changes.

Cancer is one of the most frequent health problems in our society today. It claims the lives of a quarter of our population and costs the United States billions of dollars in health care costs. According to the American Cancer Society the most cost effective way to fight cancer is through prevention and education. If even a small portion of the students who reported making changes to their lifestyles avoid cancer than this packet can be considered a success.

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Appendix A. Glossary of Terms

Acquired mutations:
gene changes that arise within individual cells and accumulate throughout a person's lifetime; also called somatic mutations

Anaplastic cells:
undifferentiated cells; these cells are a characteristic of cancer

Benign:
not harmful; in regards to tumors, one that is not cancerous.

BRAC1:
a gene that normally helps restrain cell growth

BRAC1 breast cancer susceptability gene:
a mutated version of BRAC1, which predisposes a person toward developing cancer

Cancer:
An umbrella term to describe the over 200 diseases characterized by uncontrolled cell growth

Carcinogen:
a substance that can cause cancer

Carcinogenesis:
the process by which a normal cell becomes cancerous

Colonoscopy:
examination of the colon through a flexible, lighted instrument called a colonoscope

DNA (deoxyribonucleic acid):
The material within a cell that controls the function and development of that cell.

Familial cancer:
cancer, or a predisposition towards cancer, that runs in families.

Lymph system:
Consists of lymphatic vessels and lymph nodes. It functions to return tissue fluid to the venous system and to protect the body from disease.

Malignant:
cancerous

Melanoma:
a cancer that begins in skin cells

Oncogenes:
genes which lead to the development of cancer

Proto-oncogenes:
genes that normally play a roll in the growth of cell, but when mutated can become oncogenes.

Retinoblastoma:
an eye cancer caused by the loss of a pair of tumor suppressor genes; the inherited form typically appears in childhood.

Sarcoma:
a type of cancer that starts in bone or muscle

Student t-test:
A statistical test used to determine if the differences between two sets of data are due to a factor or factors other than chance

Tumor:
a growth caused by abnormal growth

Tumor-suppressor genes:
genes that normally restrain cell growth but, when missing or inactivated by mutation, allows cells to grow uncontrolled

Appendix B. Cancer Discussion Material, Fall 1997

The following pages present the small group discussion packet as it was presented to the fall 1997 Honors 299 students. This packet of information was presented to them two weeks before they met in groups to discuss it.

Jessica walked into her human genetics class on the Monday after Fall Break and slammed her books down on her desk. Mark, who sat next to her winced, at the noise and asked her if anything was wrong.

"It's my brother and sister," Jessica said, jamming her bag under her seat, "I spent the weekend at home and we got into a huge fight."

"What was is about?" Mark asked, wanting to kill time before the class started.

"They think that I'm butting into their life, just because I happen to care about them. I just happen to want them to be around for a few years."

"I'm afraid I'm not following you."

"It's about all this cancer stuff we talked about last week," Jessica shook her head, "It's scary. My mom died five years ago from breast cancer. It was really horrible. I mean she was only 45. Way too young for something like that. Her mom died of the same thing, but it was different then. Grandma was 69 when she got it. I mean you expect cancer to start killing people at that age, but not at 45. You know how cancer supposedly kills someone in one out of three families? My family is picking up the slack. My Dad's dad died of cancer right after Dad was born. He found a lump on one of his testicles in the shower one day but didn't want to go to the doctor. So he ignored it. By the time he did go to get it checked out it was all over his stomach. He died a month later. Because he was too embarrassed to go to the doctor, my Dad never got to know his own father."

"That's rotten alright," Mark agreed, "but I'm still clueless as to how this affects you sibs."

"So are they," Jessica said, "That's the problem! They don't see, or won't see the fact that our family is a genetic time bomb, waiting to go off and kill us all! Look at our family! Mom died of cancer, one grandparent died of the same cancer, another grandparent died of a different cancer, but one that has been linked with breast cancer, and get this; I asked Dad what his grandma died of and he told me the doctor diagnosed it as a 'female problem' but Dad later thought that it was probably uterine or cervical cancer. So here we are, three generations of reproductive system cancer staring at us like a loaded gun and my siblings idea of dealing with it is turning the channel when a news story about cancer comes on."

"Would you rather they live in fear?" Mark asked.

"I'm not talking about living in fear, I'm talking about living with some common sense. Marsha, my sister is doing everything but asking outright for cancer. She smokes, she tans, she's been on the pill for years. How can she not see what she's doing to herself?"

"What about you brother?" Mark asked.

"Oh, Jim's much better!" Jessica said sarcastically. "I was really proud of him when he quit smoking, until I found out he had stared chewing tobacco. And his diet is atrocious! His idea of a balanced meal is a Big Mac in each hand! His idea of eating vegetables is getting mushrooms on a pizza."

Mark looked confused, "Mushrooms aren't a veggie,"

"That's what I told him!" Jessica shouted, "Jim eats horrible and he's not what you would call athletic. A good workout for him seems to be getting up and going to the door to meet the pizza delivery guy."

Mark laughed, "I bet you're exaggerating at least a little bit, but I know what you mean. It sounds a lot like my family. My dad died a couple of years ago from pancreatic cancer. He was only fifty-seven. His mom had died of the same thing when she was about the same age and her dad died of it too. Pancreatic cancer is rare, but almost no one survives it. It really shook me and my uncles up, because it just seemed to be a line of death pointing right to us. My uncle Carl and I really started looking at the way we live our lives. we started making some small changes. I eat fast food less often, try to exercise at least three times a week and have cut out preserved meats like lunch slices all together. Carl did some of the same stuff. He also makes sure that he gets a thorough physical every year. My other uncle went just the opposite way. Uncle Dan manages a service station so he is around gas and oil fumes all the time and those have been linked to pancreatic cancer. He still eats lousy and I know he hasn't been to a doctor since my Dad was diagnosed. He's too afraid to go. Carl and I have tried to talk to him, but he always ends up getting upset. I finally realized that as much as I wish there were, there's nothing I can do. Dan has to live his own life."

"But I can't accept that," Jessica said, "Why should I accept that both of my siblings will probably be dead because of something that they can prevent, or at the

very least postpone? I'm doing everything I can to avoid cancer, why can't they? I avoid fat like the plague, I get four servings of vegetables a day, and take supplements of vitamins A, C, and E, I exercise at least forty-five minutes a day, I don't smoke, and I use SPF 6000 sunscreen. I don't think it's too much to ask for my siblings to care for themselves, do you?"

Mark was about to reply when the professor walked in to start class.

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Cancer. For many, the word alone is enough to generate fear. Cancer affects everyone. During their lifetime, one out of every three people in the United States will be diagnosed with cancer. It will kill every fourth person (American Cancer Society, 1997a). Cancer related costs in the United States total $104 billion each year in treatment costs and lost productivity(Rutz, 1995).

Table 1. Leading causes of death in the United States

Rank	Cause of Death	Number of Deaths	Death Rate per 100,000	Percent of total Deaths
1	Heart Diseases	717,706	214.1	33.0
2	Cancer	520,578	172.2	23.9
3	Cerebrovascular	143,769	41.1	6.6
4	Chronic Obstructive Lung Disease	91,938	28.4	4.2
5	Accidents	86,777	30.6	4.0

What is cancer?

Cancer is a term referring to a group of over 200 diseases characterized by the abnormal growth and spread of cells. Normally, new cells develop at a rate controlled by the body. Cell to cell interactions and feedback mechanisms stimulate and inhibit new growth of normal cells. However, sometimes, due to a series of changes in the cell, the mechanisms controlling the division of cells breaks down and the cell divides

uncontrollably, creating a tumor.

A tumor can be benign or malignant. Benign tumors do not spread to other parts of the body and are seldom life threatening. Malignant tumors however are very life-threatening. These tumors invade and destroy surrounding tissue. When pieces of a tumor break off they can spread to other areas of the body in a process called metastasis. The most common mode for cancer to spread is through the lymph system. This is why lymph nodes are often removed and tested during surgery to remove tumors.

Another characteristic of malignant cells is that they lose their differentiation. These are called anaplastic cells. The less differentiated the cancer cells, typically the more aggressive the tumor.

Cancer kills by taking over portions of the body which perform essential functions. If cancer is affecting the lungs, then eventually there is too little effective lung tissue to absorb oxygen. If the cancer affects the liver then it disrupts the chemical balance in the body.

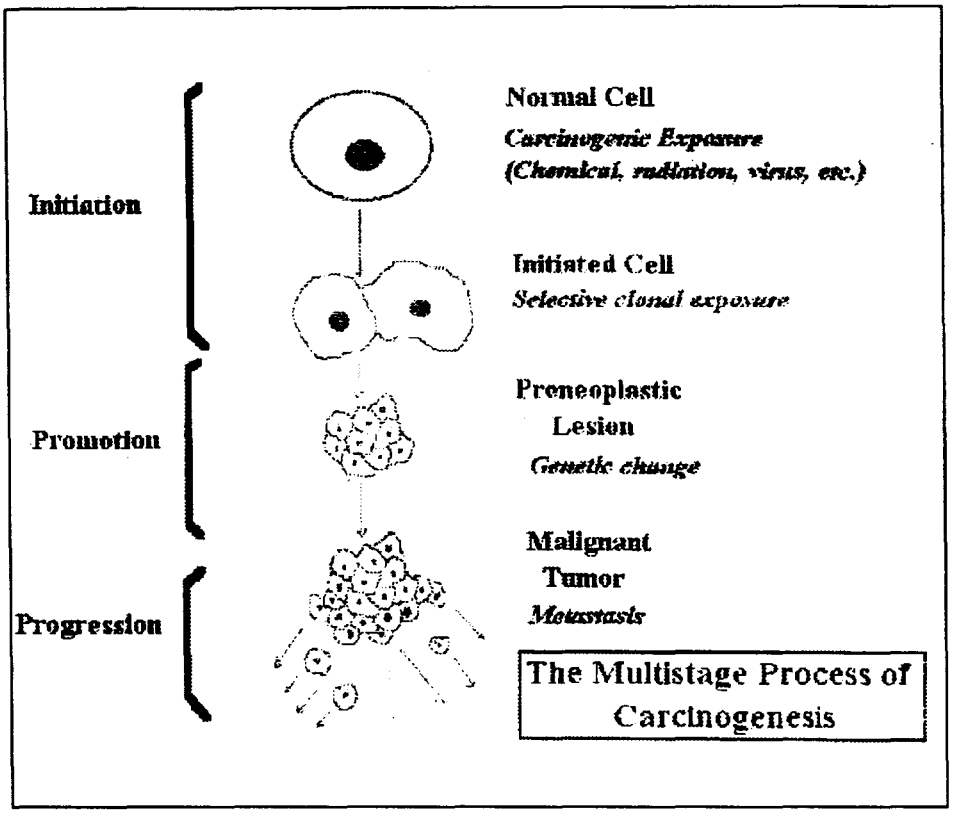
While cancer is still a deadly disease there has been progress in fighting it. Near the turn of the century, cancer had a very near 100% mortality rate. By the 1930's only one out of four patients with cancer could expect to survive. Currently the five year survival rate for all types of cancer is over forty percent (American Cancer Society, 1997n). For many individual types of cancer the survival rate is much higher. Breast, Uterine, Melanoma, Prostate, Testis, Thyroid and Urinary bladder cancer all have five year survival rates of over eighty percent (American Cancer Society, 1997h).

What causes cancer?

Carcinogenesis is the process by which a normal cell becomes cancerous. This is not an immediate change, but a gradual process that can take years. The multiple hit hypothesis is currently believed to accurately describe carcinogenesis. Carcinogenesis involves multiple changes to the cell's DNA. Many different factors are involved in these "hits." These DNA changes are cumulative and over time can lead to cancer. This is why cancer can so often affects people years or even decades after their exposure to a carcinogen. It is also a reason why Cancer is found more often in the

elderly. As a person ages they have a greater chance of encountering each of the many "hits" needed to develop cancer. Thus the longer a person's life the greater the probability that they have collected the needed "hits."

One of the most studied areas in oncology is the genetic link to cancer. Specifically, scientists are studying the role of oncogenes and tumor suppressor genes. Oncogenes are genes within the cell that may initiate the cell's transformation from normal to cancerous. Fortunately for us, naturally occurring oncogenes are rare in humans. Unfortunately, proto-oncogenes, which are more common in humans, can be converted into oncogenes by environmental factors. Proto-oncogenes are the genes involved with cellular growth and reproduction. These genes are essential for survival. However, if the proto-oncogene is damaged and removed from the control of its regulatory genes it becomes an oncogene. This oncogene, if other factors are favorable can cause cancer.



The Multistage Process of Carcinogenesis

A cell with an active oncogene is said to be initiated. Promotion stimulates an initiated cell to divide. This occurs over a period of time. Promoters include dietary fat, alcohol and the chemicals in preserved foods. There are also antipromotors. These influence initiated cells not to divide. This group includes fiber, vitamins A, C and E.

Tumor suppressor genes also play an important role in carcinogenesis. These genes are involved in controlling the cell cycle, controlling cellular division. One

function of tumor suppressor cells is to prevent damaged cells from replicating. The P53 gene is an example. The P53 gene is responsible for the synthesis of the p53 protein. This protein senses damage to DNA in the cell and blocks reproduction until the damage is repaired. If the damage can not be repaired, p53 causes the cell to die in a process called apoptosis. This prevents cells with damaged DNA from dividing thus preventing tumors. However if one of the "hits" in the cell's life involves damage to the tumor suppressor gene, then that function is lost.

Currently it is believed that all cancer has a genetic link. The importance of this factor varies to some extent with different types of cancer. Some of the discovered genes are shown on table 2. Many genes involved with carcinogenesis have been discovered and even more are suspected but have not yet been found.

Table 2. Genes and their influence on Cancer risk

Gene	Gene class	Linked Cancer
BRCA1	Tumor suppressor	Breast, Ovary, possibly Testicular
BRAC2	Tumor Suppressor	Breast
P53	Tumor Suppressor	Many
MSH2	Mismatch repair	Colon, endometrium other
MLH2	Mismatch repair	Colon, endometrium, other
PMS1,2	Mismatch repair	Colon, other
APC	Tumor suppressor	Colon
MTS1	Tumor Suppressor	Skin, pancreas
CDK4	Tumor Suppressor	Skin
NF-1	Tumor Suppressor	Brain
NF-2	Tumor Suppressor	Brain, other
RET	Oncogene	Thyroid, other
WT1	Tumor Suppressor	Wilm's Tumor
VHL	Tumor Suppressor	Kidney, other
RB	Tumor Suppressor	Retinoblastoma, sarcoma

Many factors can cause the mutations necessary to turn proto–oncogenes into oncogenes and to damage tumor suppressor genes. These include chemical carcinogens, dietary factors, radiation, hereditary factors, viruses and spontaneous mitotic events. All of these factors determine whether or not a cell becomes cancerous.

How can cancer be prevented?

Unfortunately, cancer can not be prevented. Because cancer is influenced by so many factors no single action can prevent a person from developing cancer. However, the risks can be reduced. In order to lower the risk for developing cancer the factors influencing the disease must be understood. The risk factors can be divided into two categories; those that can be controlled and those that can't.

Some factors are simply out of a person's control. Age, race, gender, and family history all influence a person's chances of developing cancer. As a person grows older he is more likely to develop cancer. This is because they are more likely to have accumulated the genetic hits to develop cancer.

Gender also plays a role in chances of developing cancers as well as the types of cancer. In some cases this is obvious; men do not get uterine cancer and women are safe from testicular cancer. However in some cases it is not conclusive whether or not differences in Cancer rates are due to gender or lifestyle. For example, for years it was believed that men were more susceptible to lung cancer than woman. Now however as more woman are smoking, lung cancer in females has shown a significant increase. Men are still more likely to develop lung cancer, but this may be due to the fact that they are more likely to smoke.

Race also influences cancer. Black people are sixteen percent more likely to develop cancer than whites. American Indians and Asians are less likely to develop cancer than whites (American Cancer Society, 1997b). The reasons for this are not known. Scientists are unsure if these differences are due to biological differences between the races, or lifestyle differences between different cultures.

While the previous factors were out of a person's control there are many factors that are controllable. These include diet exercise, tobacco use, and exposure to environmental carcinogens. All of these factors can influence a person's chances of

developing cancer as much as any of the uncontrollable factors.

The number one factor a person can control is smoking. Tobacco smoke can be attributed to more than half of the cancer deaths in the U.S. each year (Trichopoulos et. al., 1997). Smokers are twice as likely to develop all types of cancer, and eight times as likely to develop lung cancer (Tricholoulos et. al. 1997), the leading cancer killer. In addition to increasing the chances for developing cancer, tobacco reduces the chances of recovering from cancer. Lung cancer mortality rates are 23 times higher for male smokers and 11 times higher for female smokers compared to non-smokers (American Cancer Society, 1995b).

Diet is the second most important controllable factor. As many as thirty five percent of U.S. cancer deaths are related to nutrition (American Cancer Society, 1996a). Saturated fat in general and red meat in particular have been linked to several types of cancer, including cancer of the colon, rectum and prostate. High intake of salt has also been shown to contribute to the development of stomach cancer. Limiting intake of smoke-cured, salt-preserved and nitrate-preserved meats can also lower a person's risk of developing cancer.

Consumption of large quantities of alcoholic beverages increases the incidence of cancer of the upper respiratory and digestive tracts, especially among smokers. Studies have also shown that smaller quantities, as little as two drinks per day can contribute to breast cancer.

When it comes to the diet, what is not in the diet may be as important as what is in the diet. Vegetables and fruits have been shown to have cancer preventing qualities. Fruits and vegetables with high quantities of antioxidants, vitamins A, C, and E are particularly good. The best sources of these nutrients are dark green and yellow vegetables and vegetables in the cabbage family.

There are many other known and suspected carcinogens in our environment. These include asbestos, benzene, diesel exhaust and ionizing radiation. Sources of ionizing radiation include the sun, x-rays and radon. Non-ionizing radiation, such as the radiation emitted from power lines has not been shown to cause cancer. A more recent concern is that of radio-frequency electromagnetic radiation, which is emitted by cellular phones, radio stations, and microwaves. Currently no empirical evidence has

linked this radiation to cancer. In fact even in urban areas, where this form of radiation is strongest, the energy levels are less than one-hundredth of those emitted by our own bodies (Trichopoulos et. al., 1997).

The world around us is filled with hundreds of known and suspected carcinogens and it would be impossible to avoid contact with all of them. It is important, however, to recognize the risks around us and to take steps to limit exposure as much as practical.

While it does not help prevent cancer, early detection makes a significant difference in preventing cancer deaths. Table 3 shows the recommended procedures for detecting cancer.

Table 3. Recommended procedures for early detection of Cancer.

General Physical Exam	M&F	20-40 over 40	Every 3 years Every year
Self-exam of skin	M&F	20 and over	Monthly
Sigmoidoscopy	M&F	50 and over	Every 3-5 years
Fecal Occult Blood Test	M&F	50 and over	Every year
Digital Rectal Exam	M&F	40 and over	Every year
Prostate Exam	M	50 and over	Every year
Testicle Self Exam	M	18 and over	Every month
Breast Self Exam	M&F	20 and over	Every month
Breast Clinical Exam	F	20-40 Over 40	Every 3 years Every year
Mammography	F	40-49 50 and over	Every 1-2 years Every year
Pelvic Exam	F	30 and over	Every year
Pap Test	F	18 and over	Every year*

*All women who are, or have been sexually active, or have reached age 18, should have an annual Pap test and pelvic examination. After a woman has had three or more consecutive normal exams, the Pap test may be performed less frequently at the discretion of her physician.

The key to surviving cancer is early detection. Many cancers, including testicular, breast and cervical cancer have extremely high survival rates if they are detected early.

These survival rates plummet if the cancer has spread before detection.

Despite the enormity of the cancer problem, many people still do not take simple steps to reduce their chance of getting cancer. Why? Part of this reason involves several myths about cancer. Some of these myths include:

Myth #1 Cancer is just part of growing old, so I don't have to worry about it now

While it is true that the risk of cancer increases with age, cancer is not simply a disease for old people. Cancer second only to accidents as the leading cause of death among people fifteen and under. From birth to age 39 there is a 1 in 54 chance of developing cancer (American Cancer Society, 1997k). While this may seem like a small number, it is significant. It means that three members of an average size Honors 299 class will probably develop cancer before their fortieth birthday.

Myth #2 Everything seems to cause cancer so why bother trying to avoid carcinogens?

The list of known carcinogens does seem endless, and more are always being found, but that does not mean that the only way to prevent cancer is to stop eating and breathing. Remember that not all carcinogens are equal. Some, such as tobacco have a very high correlation to many different cancers, while others, such as birth-control pills, have a much less certain correlation to one type of cancer. What is important is being able to recognize possible risk factors and their relevance to their lives. A woman with family history of breast cancer may want to find an alternative to birth control pills, while a woman with no family history of breast cancer may find the pill to be a good form a contraception.

Myth #3 Self-exams would just give you a death sentence and make you miserable during what good time you have left.

While finding a lump or abnormality during a self exam can be scary, it could also mean survival. Finding cancer early greatly increased survival rates. When treated while still localized breast cancer has a very optimistic 97% survival rate. If however it is not found until is has spread throughout the body the five year survival rate drops to

twenty percent. Localized skin cancer has a 95% survival rate, but after it has spread only 16% of patients make it to the five year mark (American Cancer Society 1997m). Self-exams don't give death sentences, they give you a chance to live.

Self-Examinations: A Key to Survival

The most important factor is surviving cancer is early detection. Breast and testicular cancer both have very high five year survival rates **if they are detected early.** To help insure that they are detected soon men and woman need to do monthly self-examinations. These are the guidelines for both breast and testicle self examinations. Remember five minutes a day could save your life.

Breast Exam

When detected early breast cancer has a 97% survival rate. If the disease spreads the survival rate drops to 20% (American Cancer Society, 1997m). Because of this monthly self exams are critical. Breast exams should be done one week after your period ends so your breasts are not tender or swollen. The following are the American Cancer Society's guidelines for performing a breast self-exam. Remember, even though it is much less common, breast cancer does affect men. Men should perform these exams as well

1. Lie down with a pillow under your right shoulder and your right arm behind your head.

2. Use the top third portion of the three middle fingers on you left hand to feel for lumps in the right breast.

3. Press firmly enough to know how your breast feels. A firm ridge in the lower curve of each breast is normal.

4. Move around the breast in a set way. You can move in a circle, up and down line or divide the breast into wedges. Whichever you chose, do it the same way each time. Go over the entire breast, and remember how your breast feels from month to month.

5. Repeat the exam to your left breast.

6. Repeat the exam while standing, with you arm behind your head. The upright position makes it easier to check the upper and outer potions of the breast. You may want to this portion of the exam in the shower. Soapy hands will make it easy to check how your breasts feel as they glide over the wet skin.

7. Do a visual inspection in front of a mirror right after your self exam each month. See if there are any changes in the way your breasts look, such as dimpling of the skin, changes in the nipple, fluid discharges from the nipple, redness or swelling.

Testicle Exam

When found early, cancer of the testicle has a very promising 99% survival rate. However, this rate drops to 72% after the disease has spread. As with breast cancer, self-examination and early detection are the key. Exams should be done monthly

1. Examine yourself after a warm shower, when the scrotal skin is relaxed.

2. Hold the Scrotum in the palms of your hands, so that you can use the fingers and thumb on both hands for the exam.

3. Note the size and weight of the testicles. One may be slightly larger or hang slightly lower, but any noticeable increase in size or weight may mean something is wrong.

4. Gently feel each testicle individually. You should feel a soft tube at the top and back of the testicle. This is the epididymis and should not be confused with an abnormal lump. The testicle should be smooth with no lumps. If you are unsure if a testicle feels normal, compare it with the other one.

5. Also look for the following symptoms.
   - A collection of fluid in the scrotum.
   - A feeling of heaviness in the scrotum.
   - A significant shrinking or enlarging of one or both testicles.

If a lump or other symptom is found on either the breast or the testicle, don't panic. Remember most lumps turn out to be benign, but you should make an appointment with your doctor right away to get his diagnosis. Remember early detection means a better chance of survival!

Appendix C: Cancer Pretest/Post-test

The test on the following pages is the exam given to the Honors 299 students both before they received the discussion packet and also immediately after their discussion. The raw scores of the students can be found in Appendix E. Results from the tests are summarized in the evaluation of case study section of part IV of this paper.

Objective	Test Items
1a. Students will recognize the societal impact of cancer	1, 10
1b. Students will learn that there are ways to minimize the impact of cancer on individuals.	2, 4,
2a. Students will understand the process by which normal cells become cancerous.	3, 5, 9, 11, 13
2b. Students will recognize lifestyle choices which can affect the process of carcinogenesis	6,7,8,12

Cancer Discussion Group Pretest

Student Grade Code Number _____

Dear Honors 299 Student,

For my Honors 499 project I am developing a small group discussion about cancer for your class. In order to evaluate its effectiveness, I will be giving pre- and post- tests about the material covered in the discussion. The tests will cover both your knowledge and your attitudes about cancer. Please answer the questions honestly and to the best of your knowledge. Neither this test nor the post test will affect your grade in Honors 299. Please write you grade code number at the top of the page so that I can compare your responses before and after the discussion group.

Thank you for you cooperation,

Tom Earhart

Please circle the answer which will correctly complete the following sentences

1. The disease responsible for killing the most children 15 and under is,

A. Cancer. B. AIDS.
C. Heart Disease. D. Multiple Sclerosis

2. The key to surviving most cancers is,

A. Aggressive chemotherapy. B. Early detection.
B. Invasive surgery. D. Radiation therapy.

3. The following has not been empirically linked to cancer.

A. Diesel fumes. B. Radon.
C. Smoked meats. D. Cellular Phones.

4. Breast and testicular self-exams should be done

A. Weekly. B. Every two weeks.
C. Monthly. C. Every two months.

5. Oncogenes are

A. Common in the human body. B. Genes leading to cancer.
B. The only cause for cancer. D. Only found in viruses.

6. Antipromoters include all but

A. Vitamin A. B. Vitamin C.
C. Vitamin B. D. Fiber.

7. The most important controllable factor determining if a person gets cancer is

A. Smoking. B. Heredity.
B. Diet. D. Chemical exposure.

8. The recommended number of fruits and vegetables needed each day is

A. Three. B. Four.
C. Five. D Six.

9. Cancer is generally thought of as caused by

A. Heredity. B. Exposure to carcinogens.
C. Damage to the immune system. D. Multiple factors.

10. The chance of developing cancer before the age of 40 is about

A. 1 in 500. B. 1 in 100.
C. 1 in 50. D. 1 in 25.

Please answer the following questions:

11. Why is cancer more likely to strike the elderly?

12. How would you be willing to change your lifestyle in order to prevent cancer?

13. Why might the cancer rate in Utah be lower than the cancer rate in California?

Please circle the response that describes your feelings about the following statements.

1. I feel comfortable talking about cancer

Strongly Agree Agree Not Sure Disagree Strongly Disagree

2. I am concerned that I will develop cancer

Strongly Agree Agree Not Sure Disagree Strongly Disagree

3. I try to avoid choices that might put me at risk of developing cancer

Strongly Agree Agree Not Sure Disagree Strongly Disagree

Please tell me what you hope to get out of the discussion group on cancer.

Thank you again for you participation with this project

Appendix D. Raw Data Section

The following tables shows the raw data for the students test scores. Students identified themselves by way of an identification number. When students left the identification number blank or there were more than one test with the same number, handwriting was used to match pretests with post-tests.

Student ID	Pre-test	Post-test	Change	Student ID	Pre-test	Post-test	Change
289		10	NA	501	9	10	1
502	8		NA	503		12	NA
504	9	11	2	505	6	10	4
506	7	9	2	507	8	11	3
507	8	11	3	508	9	10	1
509	10	13	3	511		9	NA
512	7	8	1	513	6	10	4
514		11	NA	515	9	12	3
515	9	12	3	525	9	9	0
526	4		NA	526	10	10	0
528	10	9	-1	529	9		NA
530	7	11	-4	552		10	NA
601	8	7	-1	603	11	8	-3
604	9	11	2	605	13	12	-1
607	9	12	3	609	9	12	3
701	12		NA	702	8	9	1
703	10	11	1	704	9		NA
706	7	9	2	707	8	9	1
709	7	9	2	711	9	10	1
711	8	10	2	712	6	6	0
713	10	6	-4	715	9	11	2
716	10		NA	716	8	12	4
717	7	8	1	718	10	9	-1
719		10	NA	721	10	11	1
722	8	11	3	723	7	8	1
724	3	11	8	801	7	9	2

805	11	9	-2	807	8	12	4
808	5	9	4	809	9	9	0
811	9	12	3	812	6	11	5
813	4		NA	813	9		NA
820	10		NA	821	7	10	3
824	10	11	1	827	4	12	8
828	10	12	2	829	10		NA
901	11	13	2	902	8	10	2
903	12	11	-1	904	8	10	2
905	9	11	2	906	8	8	0
911		11	NA	912	8	9	1
Senior	11		NA	Colin		8	NA
Blank		8	NA	Blank		10	NA
Blank		13	NA	Blank		12	NA
Blank		7	NA				